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AN INDEX OF GENERAL BUSINESS CONDITIONS

WARREN M. PERSONS

I. THE INDEX: A STATEMENT OF RESULTS

1. A Tentative Index of General Business Conditions

IT is possible to measure general business prosperity and depression. Further, it is possible to ascertain the sequence of the phenomena — speculation, physical production, failures, prices, interest rates — of the business cycle.

The result of the present study is the chart on the opposite page; it presents the Index of General Business Conditions for the period 1903–14. The relative fluctuations of the five curves appearing as the main and supplementary sections of the chart indicate the sequence of activity for five business and financial groups.

The curves are plotted for the period 1903–18, but they do not have the same significance for the period following the outbreak of war that they do for the pre-war period; they are plotted in two sections merely as an expedient to avoid the confusion which would result from placing them all together. The curve for Group IV, consisting of wholesale prices of commodities, is placed on both sections as a basis of comparison.

The curves have been constructed on the basis of conclusions obtained from an extended analysis of business statistics. Trade papers, financial journals, and government publications were examined for suitable statistical data. Some fifty series were considered: of these, twenty-three series were analyzed, corrected, and compared; three series — the rate on call loans, tonnage of vessels entered in the foreign commerce of the United States, and incorporations in eastern states — were found not to be suitable for our purpose. The remaining twenty series present well marked cyclical fluctuations or wave movements, connected with the ebb and flow of business activity.

The waves of the twenty series possess both similarities and differences. For all series the elapsed periods from crest to crest, or trough to trough, are approximately the same. The *times*, however, at which crests or troughs of the several series occur are, in general, not the same. Nevertheless, there are groups of series in which the wave movements are simultaneous. These groups, five in number, are composed of series having cyclical fluctuations which are both similar and simultaneous. The synchronous items of the series in each group were averaged, so that five series of synthetic group indices were secured. These five series of indices epitomize the business situation. They are presented graphically by the five curves of our chart.

All groups, as shown by the curves, reveal similar wave movements; but the waves of the five groups move, not simultaneously, but consecutively. Group I consists of the rate of interest yielded by ten American railroad bonds,[1] the average price of twenty railroad stocks,[2] and the average price of industrial stocks.[2] These three series constitute a group because they have synchronous fluctuations. The fluctuations of Group I precede those of Group II by two to four months. Group II consists of bank clearings of New York City, the value of building permits issued for twenty leading cities, and the number of shares sold on the New York Stock Exchange.[2] Group II precedes Group III by two to four months. Group III comprises tonnage of pig iron produced in the United States, bank clearings of the United States outside New York City, the value of imports of merchandise into the United States, unfilled orders of the United States Steel Corporation,[3] and Bradstreet's number of business failures.[1] Group III precedes Group IV by two to four months. Group IV[4] is composed of Bradstreet's index of commodity prices, gross earnings of ten leading railroads, index numbers of wholesale prices of all commodities (United States Bureau of Labor Statistics), and average reserves of the New York City Clearing House Banks.[1] Group IV precedes Group V by four to six months. Group V consists of average loans of the New York City Clearing House Banks,[1, 5] average deposit of the New York City Clearing House Banks,[1, 5] rate of interest on four-to-six months commercial paper in New York, rate of interest on sixty-to-ninety day commercial paper in New York, and dividend payments by industrial corporations. The order of these groups was determined, not by recording the dates of maximum and minimum items (the dates of the crests and the troughs of the waves), but by comparing all the items of each series with all the items of the remaining series, as described in detail in Part II of this paper.[6]

On the basis of the study of the fluctuations of twenty series of statistics for the limited period 1903–14 we may venture to give a tentative formulation of the sequence of events during that period. The order of

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[1] In averaging, the algebraic signs of the items of this series were reversed.

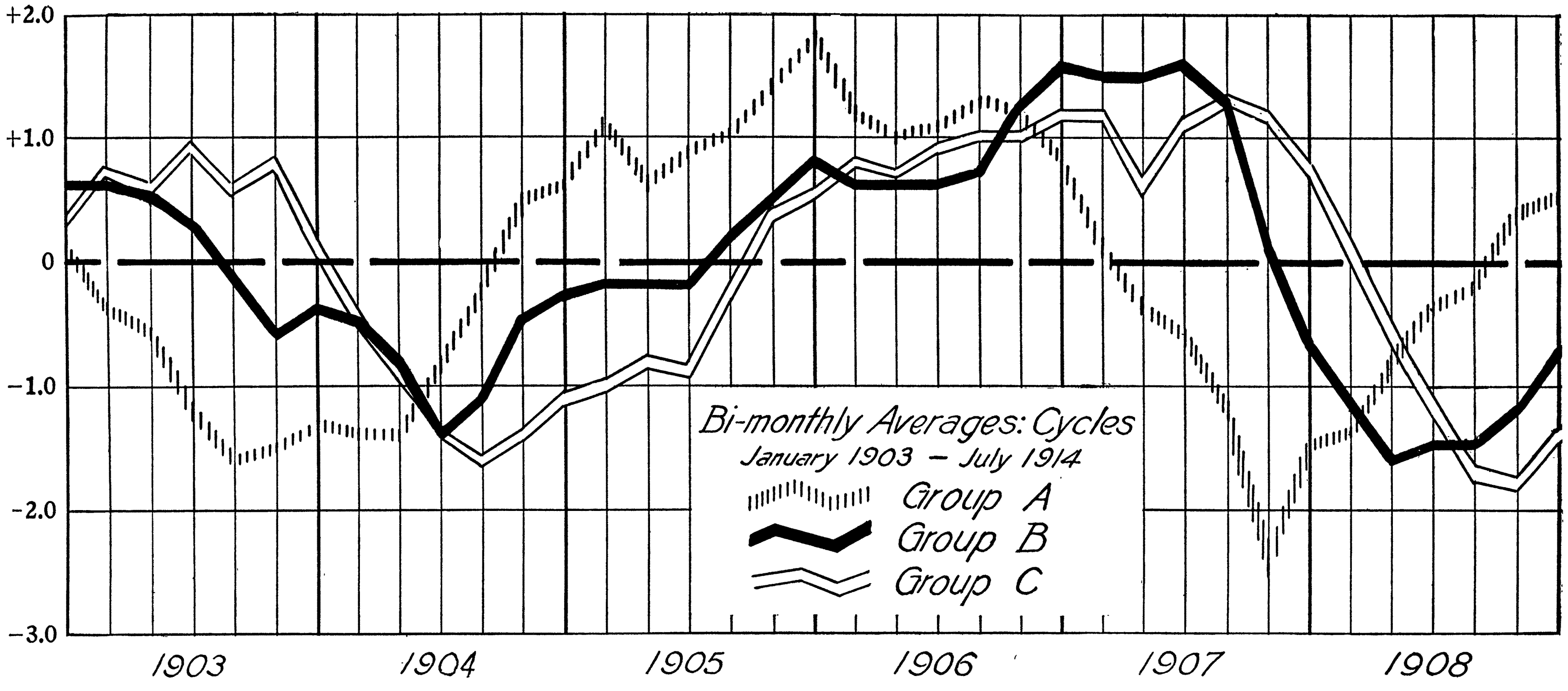
[2] These series do not enter the average for the period August to December 1914 when the New York Stock Exchange was closed.

[3] This series was not included in the average prior to June 1910, since monthly figures are not available.

[4] In computing averages for Group IV only the two price series were used.

[5] These series do not enter the average for the period beginning August 1914.

[6] In a broader classification the series of Groups I and II would be combined, and those of Groups III and IV. There are series which are difficult to classify. For instance, there are reasons for assigning New York clearings to Group I instead of Group II. There is no question, however, concerning the legitimacy of the general scheme of classification and the grouping of series according to it.



BIMONTHLY AVERAGES OF CYCLES OF GROUPS A, B, AND C

Group A. Yield of Ten Railroad Bonds;* Price of Industrial Stocks; Price of Twenty Railroad Stocks; New York Clearings.

Group B. Pig-iron Production; Outside Clearings; Bradstreet's Prices; Bureau of Labor Prices; Reserves of New York Banks.*

Group C. Rate on Four-to-six Months Paper; Rate on Sixty-to-ninety Day Paper; Loans of New York Banks;* Deposits of New York Banks.*

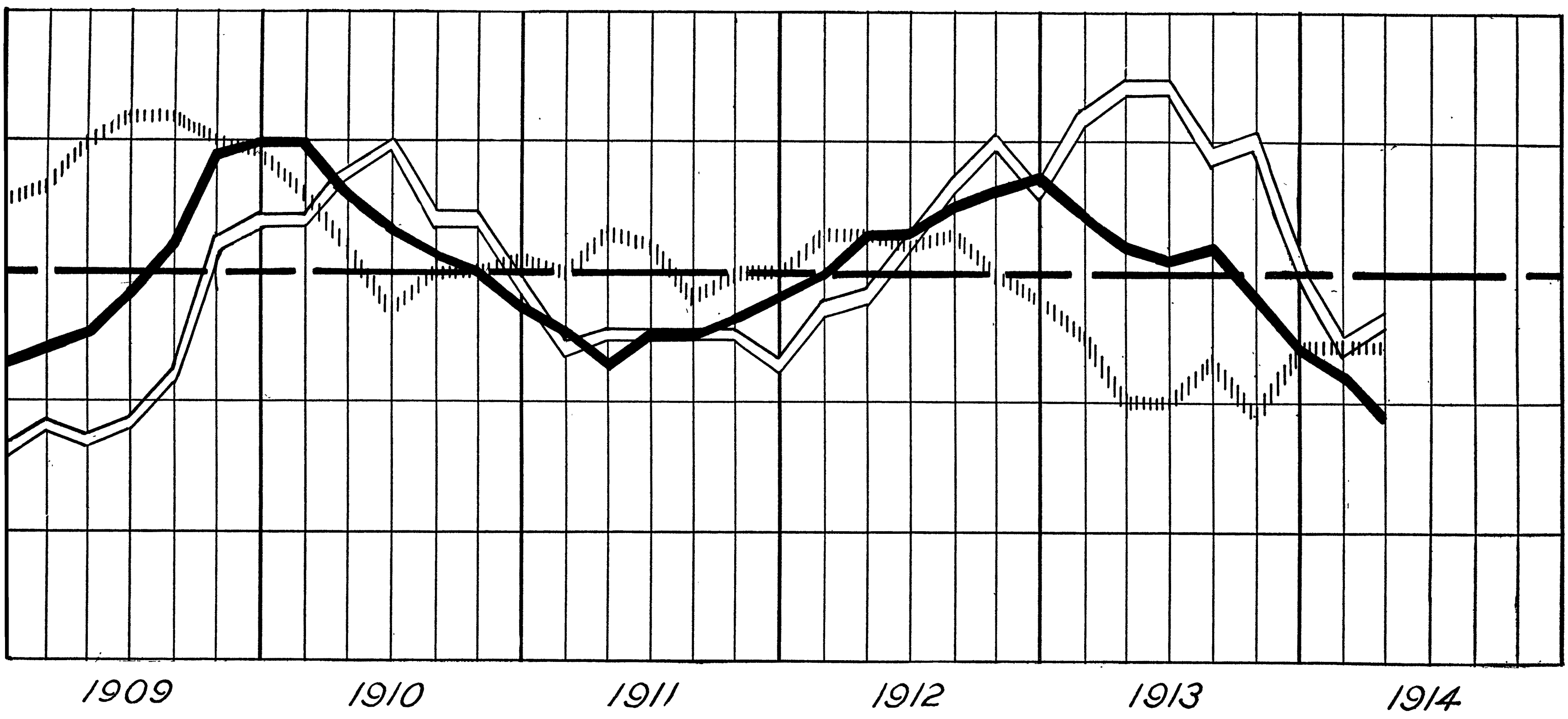
(*Units are one-tenth of one per cent*)

	1903			1904			1905			1906			1907			1908		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
January–February ..	+ 1	+ 6	+ 3	−13	− 4	+ 1	+ 6	− 3	−11	+18	+ 8	+ 5	+ 8	+16	+12	−15	− 7	+ 8
March–April	− 4	+ 6	+ 7	−14	− 5	− 5	+11	− 2	−10	+12	+ 6	+ 8	+ 1	+15	+12	−14	−12	+ 1
May–June	− 6	+ 5	+ 6	−14	− 8	− 9	+ 6	− 2	− 8	+10	+ 6	+ 7	− 4	+15	+ 6	− 8	−16	− 6
July–August........	−12	+ 3	+ 9	− 8	−14	−14	+ 9	− 2	− 9	+11	+ 6	+ 9	− 6	+16	+11	− 4	−15	−12
September–October .	−16	− 1	+ 6	− 2	−11	−16	+10	+ 2	− 3	+13	+ 7	+10	−12	+13	+13	− 2	−15	−17
November–December	−15	− 6	+ 8	+ 5	− 5	−14	+14	+ 5	+ 4	+12	+13	+10	−24	+ 1	+12	+ 4	−12	−18

* Reversed in sign.

fluctuations indicates: prices of securities reached a maximum at the same time the rate for capital was at a minimum (Group I); the value of building permits and general activity in the financial center (as indicated by New York clearings, Group II) reached maxima four months later. Two months later still, general business and industrial activity throughout the country reached maxima (as indicated by the production of pig iron, outside clearings, imports, and unfilled orders of the United States Steel Corporation, Group III). At this time business failures were at a minimum. Two months later railroad gross earnings and commodity prices reached maxima and bank reserves a minimum (Group IV). Meanwhile both the capital rate and the bank rate had stiffened, the former reaching maximum. Four months later loans and deposits reached minima and the bank rate reached maximum (Group V). In ordinary times loans and the bank rate move inversely; in the panic of 1907 they moved, first upward and then downward, together. The entire series of events covered from fourteen to sixteen months. These statements are descriptive of a typical or average sequence of events in the upward swing of the cycle.

The tentative statements of the sequence of events given in the preceding paragraph are based upon correlation coefficients which in turn are based upon a comparison of *all* the items of one series with *all* the items of the other series. In the charts of the twenty series of cycles, the maximum and minimum points attract attention. A description of the nature of the fluctuations, based *exclusively* upon inspection of the turning points, during the period previous to the panic of September–October 1907, is presented in the following summary statement:



BIMONTHLY AVERAGES OF CYCLES OF GROUPS A, B, AND C

GROUP A. YIELD OF TEN RAILROAD BONDS;* PRICE OF INDUSTRIAL STOCKS; PRICE OF TWENTY RAILROAD STOCKS; NEW YORK CLEARINGS.

GROUP B. PIG-IRON PRODUCTION; OUTSIDE CLEARINGS; BRADSTREET'S PRICES; BUREAU OF LABOR PRICES; RESERVES OF NEW YORK BANKS.*

GROUP C. RATE ON FOUR-TO-SIX MONTHS PAPER; RATE ON SIXTY-TO-NINETY DAY PAPER; LOANS OF NEW YORK BANKS;* DEPOSITS OF NEW YORK BANKS.*

(*Units are one-tenth of one per cent*)

	1909			1910			1911			1912			1913			1914		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
January–February	+5	−7	−14	+9	+10	+4	+1	−3	−1	0	−2	−7	−2	+7	+6	−6	−6	0
March–April	+6	−6	−12	+6	+10	+4	0	−5	−6	+3	0	−3	−5	+4	+12	−6	−8	−6
May–June	+10	−5	−13	+2	+6	+8	+3	−7	−5	+3	+3	−2	−10	+2	+14	−6	−11	−4
July–August	+12	−2	−12	−3	+3	+10	+2	−5	−5	+2	+3	+2	−10	+1	+14			
September–October	+12	+2	−8	0	+1	+4	−2	−5	−5	+3	+5	+7	−7	+2	+9			
November–December	+10	+9	+2	0	0	+4	0	−4	−5	0	+6	+10	−11	−2	+10			

* Reversed in sign.

Dates of Maximum and Minimum of Each Series of Cycles during the Period Including the Panic of September–October 1907

Group I. The minimum yield of ten railroad bonds (Chart 112) occurred in the middle of 1905. After that time there was a steady rise to a maximum in November 1907 and a fall to a minimum in the first part of 1909.

The maximum average price of twenty railroad stocks (Chart 120) occurred in January–September 1906. There was a steady decline from September 1906 to the minimum of November 1907.

The maximum average price of industrial stocks (Chart 118) was reached in January 1906 followed by a fairly steady fall to the minimum of November 1907.

These three series of Group I reached turning points from two years to one year before the panic.

Group II. The maximum figure for bank clearings of New York City (Chart 101) was reached in January 1906, but subsequent figures continued to be high (though erratic) until March 1907. The minimum was reached in December 1907.

The number of shares sold on the New York Stock Exchange (Chart 108) was high, though erratic, from January 1906 to March 1907. The figures were low from June 1907 until after the panic in the autumn.

The value of building permits issued for twenty leading cities (Chart 106) was high from the middle of 1905 until the maximum was reached in the spring of 1907. The minimum occurred in March 1908.

The three series of Group II reached turning points from eighteen months to six months before the panic.

Group III. Bradstreet's number of business failures (Chart 111) was low from the spring of 1906 to August

1907, the minimum occurring in January 1907. The maximum was reached in January 1908.

Unfilled orders of the United States Steel Corporation (Chart 109) reached maximum in December 1906, falling gradually from that time to the middle of 1908.

The tonnage of pig iron produced in the United States (Chart 102) was high from the first part of 1906 to October 1907, falling precipitately to a minimum in the first half of 1908.

Bank clearings of the United States outside New York City (Chart 103) were high from January to October 1907. Then there was a violent fall to the minimum in December 1907.

The value of imports of merchandise into the United States (Chart 105) was high from December 1906 to August 1907. The minimum was reached in the first quarter of 1908.

The five series of Group III reached turning points only a month or two before the panic, except that the decline in the *quarterly* figures for unfilled orders of the United States Steel Corporation indicate that *if monthly figures had been available* for this series the panic might have been forecasted by four months or more.

Group IV. Bradstreet's index of commodity prices (Chart 104) reached maximum during the first half of 1907, having risen rapidly during the second half of 1906. The drop from July 1907 to the minimum of June 1908 was rapid.

The Bureau of Labor index numbers of wholesale prices of all commodities (Chart 116) was at a maximum from February to October 1907. Both the rise (from the middle of 1906 to February 1907) and the fall (from October 1907 to the second half of 1908) were precipitate.

The average reserves of New York City Clearing House banks (Chart 123) were subnormal from January 1906 until the minimum was reached in November 1907. The recovery to the maximum of September 1908 was uninterrupted.

The gross earnings of ten leading railroads (Chart 107) rose steadily from the level of 1906 to the maximum of May 1907 and then fell to the minimum in July 1908.

The four series of Group IV are not very strongly differentiated from those of Group III. Bradstreet's prices began to fall a month or two before the panic, but the Bureau of Labor prices continued high until October. Reserves were low for a year and a half before the panic, but the turning point upward was not reached until November. Railroad gross earnings began to drop in the middle of 1907.

Group V. Average loans and average deposits of New York City Clearing House banks (Charts 122, 124) were both low for a year and a half previous to September 1907. The oscillations of these two series lag behind those of reserves by a couple of months. Both series show the effects of the panicky conditions in the spring and autumn by increasing and then decreasing.

Interest rates on commercial paper (Charts 113, 114) rose steadily during the two years ending with July 1907 and then rose violently to the maximum of December 1907.

The violent fluctuations in dividend payments by industrial corporations (Chart 117) make the location of a turning point uncertain. It may have occurred in the latter part of 1906, but there is also a high point in September 1907.

The turning points of the series of Group V apparently occurred a month or more after the panic broke.

The five curves, I to V, of the frontispiece do not show the sequence of fluctuations as well as the three curves of the chart at the top of the preceding pages (pp. 112, 113). That chart shows the curves based upon three groups (A, B, and C) of series of *bimonthly* items for the period 1903–14. This new grouping was made in order to secure a clearer picture of the time relationship of the cyclical movements than is given by five groups of series of monthly items. Bimonthly, rather than monthly, items were averaged in order to smooth the month-to-month oscillations, in which oscillations we are not interested; the series which fluctuate more erratically than others, value of building permits, shares traded, imports, railroad gross earnings, business failures, and dividend payments, were excluded from the averages; unfilled orders of the United States Steel Corporation were not included because of the lack of bimonthly data. Group A, consisting of four series, affords an index of speculation; Group B, consisting of five series, affords an index of physical productivity and commodity prices combined; Group C, consisting of four series, affords an index of the financial situation in New York. During the pre-war period the cyclical fluctuations of Group A systematically precede in time those of Group B, and those of Group B systematically precede those of Group C.

The criteria for grouping the series are, then, (*a*) similarity and (*b*) simultaneity of the cyclical fluctuations. In order to apply these criteria it was necessary (*a*) to isolate the cyclical element from the actual data and (*b*) to adopt a method for comparing cycles. To isolate the cyclical element it was necessary to correct the actual data for secular trend and seasonal variation. Definitions of the concepts just named are given in the following section of the paper. The methods adopted of correcting individual series and of comparing the corrected series are described in Part II of this paper.

2. Definition of Terms

The data used as a basis for the general conclusions stated in the preceding section are monthly items of the industrial, commercial, and financial statistics which ordinarily serve as the basis for judgments concerning fundamental business conditions. Each item is a composite. More specifically, the actual items are composed of four constituents: secular trend, seasonal variation, cyclical fluctuations, and a residual element.[1]

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[1] *Review of Economic Statistics*, January, 1919, pp. 5–8.

The *secular trend* is the regular increase or decrease, according to some principle, over the whole period under consideration. For most series it is a growth element, dependent upon population and the development of industry. As used in this study, the expression " secular trend " may refer either to a statistical series or to one item of a series. When it refers to a series it means the smooth curve fitted to the data. In case the smooth curve is a straight line the secular trend is measured by the slope of the straight line. When the expression refers to one item of a series it designates the vertical distance (or its numerical value) from the curve or line of trend to the zero or base line. In the present investigation we have dealt exclusively with *linear* secular trend, that is, the straight line determined for each series.[1]

The *seasonal variation* is the movement of the items within the year which we attribute to the round of the seasons. Although an iron-clad system is not to be expected, the movement of the items, to be seasonal, must be systematic year after year. The seasonal variation of an item for any month is given by an index which expresses the " normal " for that month as a percentage of the average for the year.[2]

The *cycles* are the numerical values secured by removing from the original items the secular trend and the seasonal variation, and expressing the results in terms of comparable units, the standard deviations of the respective series. The cycles are the " percentage deviations of original items from secular trend corrected for seasonal variation " divided by the " standard deviation." The figures thus corrected and expressed measure the rhythmic movement of business, the ebb and flow corresponding to depression and prosperity.[3]

3. The Data Used

The monthly series of business statistics analyzed for secular trend, seasonal variation, and cyclical movement, together with the periods covered, sources, and dates of publication of current items, are given in Table A.

In the process of analysis, the secular trend and seasonal variation were explicitly determined by a method which revealed the distinctive characteristics of the individual series. For instance, the rates on short time commercial paper have been decidedly downward since 1890, the " spring rise " in the stock market appears to be a fiction, bank clearings are markedly high in autumn and winter as compared with summer, and short time interest rates are shown to have a characteristic seasonal movement. It was not the purpose of the present study, however, to make an analysis of such features as these. It is the cyclical fluctuations which have received especial attention. Further, in dealing with the cyclical fluctuations the aim has been to measure them, rather than to utilize the results in constructing a theory of business cycles.

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[1] *Review of Economic Statistics*, January, 1919, pp. 8–18.

[2] *Ibid.*, pp. 18–31.

[3] *Ibid.*, pp. 31–36.

TABLE A. — SERIES ANALYZED, PERIODS COVERED, SOURCES AND DATES OF PUBLICATION OF CURRENT DATA

Series †	Original data covering period	The secular trend computed for the period	Seasonal variation measured for period	Source of current data	Date on which current items are available
1. New York Clearings	Jan. 1903 to date	1903–16	Jan. 1903–Jan. 1917	Commercial and Financial Chronicle	First or second issue of following month
2. Production of Pig Iron	"	"	" "	Iron Age	Second issue of following month
3. Outside Clearings	"	"	" "	Commercial and Financial Chronicle	First or second issue of following month
4. Bradstreet's Prices	"	1903–14	" "	Bradstreet's	Second or third issue of same month
5. Imports	"	1903–16	" "	New York Journal of Commerce. Detailed data in Monthly Summary of Foreign Commerce of the United States	Four significant figures between twentieth and twenty-fifth of following month. In full between twenty-fifth and end of following month
6. Building Permits	"	"	" "	Babson's Desk Sheet	Last part of following month
7. Railroad Gross Earnings	Jan. 1903–June 1917	"	" "	Commercial and Financial Chronicle	Second or third week of second following month
8. Shares Traded	Jan. 1903 to date	"	" "	Bank and Quotation Section of the Commercial and Financial Chronicle *	Published each month with the first issue of the Chronicle

* Data also obtainable in *Bradstreet's;* see " Measures of Movements."

† Cycles of the various series were computed for the period 1903 to date except for the following series: No. 7 (1903–17), No. 9 (1902 to date), Nos. 10, 15 (cycles not computed), Nos. 18, 20 (1901 to date), Nos. 22, 23, 24 (1903–14).

TABLE A. — *Continued*

Series *	Original data covering period	The secular trend computed for the period	Seasonal variation measured for period	Source of current data	Date on which current items are available
9. Unfilled Orders U. S. Steel Corporation	Oct. 1901 to date †	Two straight lines were fitted; one for the period 1908–14 and the other for the period June 1902–December 1916	Not measured	Commercial and Financial Chronicle	Second or third issue of following month
10. Tonnage Entered	Jan. 1900–Dec. 1917 §	1900–17, not including the years 1912–13	Jan. 1900–Dec. 1917 §	Monthly Summary of Foreign Commerce of the United States	Two or three months after date of figures
11. Business Failures (Bradstreet)	Jan. 1893 to date	1903–16	Jan. 1893–Jan. 1917	Bradstreet's	First issue of following month, but not before third day of month
12. Yield of 10 Railroad Bonds	Jan. 1890 to date	"	Jan. 1890–Jan. 1917 ‡	Bank and Quotation Section of the Commercial and Financial Chronicle	Published each month with the first issue of the Chronicle. Figures for a given month appear in the Supplement of the following month ‡‡
13. Rate on 4–6 Months Paper	"	Two straight lines were fitted; one for the period 1890–1915 and the other for the period 1903–16	Jan. 1890–Dec. 1915	" "	" "
14. Rate on 60–90 Day Paper	"	1903–16	Jan. 1890–Jan. 1917	" "	" "
15. Rate on Call Loans	"	No straight line was fitted	Jan. 1890–Jan. 1917	" "	" "
16. Bureau of Labor Prices	Jan. 1900 to date	1903–14	Jan. 1900–Dec. 1913 ‡	Federal Reserve Bulletin and Bulletin of the Bureau of Labor Statistics ††	About twentieth of following month
17. Dividend Payments	Jan. 1902 to date	1903–16	Dec. 1902–Dec. 1917	New York Journal of Commerce	Between twentieth of preceding and fifth of same month
18. Price of Industrials	Jan. 1897 to date	1901–13	Jan. 1897–Jan. 1914 ‡	Wall Street Journal **	Between third and fifteenth of following month
20. Price of 20 Railroads	Jan. 1897 to date	"	Jan. 1897–Jan. 1917 ‡	" "	" "
21. Incorporations in Eastern States	Jan. 1901 to date	1901–16	Jan. 1901–Mar. 1918	New York Journal of Commerce **	Between first and tenth of following month
22. Loans New York Banks	Jan. 1879–July 1914	1903–13	Jan. 1879–Jan. 1914	Commercial and Financial Chronicle.	First issue of following month
23. Reserves New York Banks	"	"	" "	" "	" "
24. Deposits New York Banks	"	"	" "	" "	" "

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* Cycles of the various series were computed for the period 1903 to date except for the following series: No. 7 (1903–17), No. 9 (1902 to date), Nos. 10, 15 (cycles not computed), Nos. 18, 20 (1901 to date), Nos. 22, 23, 24 (1903–14). † Quarterly data only prior to June 1910.

‡ Indices of variation were computed for this series, but there is no evidence of a *seasonal* variation.

§ Series discontinued; data lacking for years 1912 and 1913.

** Data also obtainable in *Bradstreet's;* see "Measures of Movements."

†† First available in the *Federal Reserve Bulletin.* Although this *Bulletin* is dated the first of the month it actually appears after the twentieth of the month. Prices for two months preceding are published, thus the March *Bulletin* gives the indices for January.

‡‡ Average yields for Series 12 computed by the Review.

4. Effects of Transition from Peace to War and War to Peace

The cycles of twenty series were computed and compared for the period 1903–18. The grouping of the series, however, was determined by the comparison for the period January 1903–July 1914 only. The reason is obvious. The systematic relation of the fluctuations which held during the pre-war period was shattered by the outbreak of war.

We are using past data as a basis for interpreting the present. The data are for peace times. At present we are in a period of transition from war to peace. It is not likely that the disturbed conditions of war time will persist; it is likely that there will be a return to " normal" conditions. On the other hand, it is evident that this return to normal will not be violent, but gradual.

The interpretation of statistical data at any time is full of difficulties; at the present time the difficulties are extreme. If the fluctuations of statistical series return to normal, will the transition take a few months or several years? Is a tendency to return already evident? What are the peculiarities of current data? These are questions reserved for consideration in subsequent numbers of the REVIEW, and in the MONTHLY SUPPLEMENTS which will be devoted to the analysis of current statistics.

The Index of General Business Conditions presented has been constructed from the data for the period 1903 to 1914, and is offered as a guide to the relations that exist among economic phenomena in ordinary peace times. It obviously is of no value in interpreting the connection that existed during the Great War, but is offered in the belief that it will prove serviceable in the study of conditions following the establishment of peace. While the war may have changed many things, it probably has not altered the fundamental conditions which in ordinary times produce fluctuations in business activity. It may be expected, therefore, that, as conditions return to normal, the relations that existed between most, if not all, of our series of economic and business statistics will tend to be reëstablished upon the basis which obtained from 1903 to 1914. To the extent that this expectation proves justified, the Index of General Business Conditions should prove a serviceable guide to the fundamental economic movements of the years that lie ahead.

The statements made in the preceding sections are conclusions. These conclusions have been presented, so far as possible, in non-technical language. They have been drawn, however, only by the application to business data of a considerable amount of mathematical and statistical technique. The soundness of the analysis and technique conditions the soundness of the conclusions reached. In accordance with scientific usage we shall give a complete explanation of the basis of our conclusions so that it will be possible for anyone interested to follow the argument step by step. This explanation, however, cannot be made entirely non-technical. The individual items used are themselves composite; they are symptomatic of the activity of a complex economic organization; the methods developed cover a large portion of the theory of statistics; the concepts involved demand careful examination; the nature of economic correlation and causation requires scrutiny.

Consideration of the nature of the data used, a detailed description of the statistical methods developed for correcting the original items and comparing the corrected series, and definitions of concepts, these are presented in Part II of this study. The attempt will be made to present the ideas and arguments clearly and non-technically. The complexities of the subject, however, make the difficulties of exposition considerable. We shall attempt to secure simplicity and accuracy in statement. When there appears to be a choice between the two, however, the latter will not be sacrificed to the former.

Anyone interested only in results and willing to accept our results on authority will find them summarized in the preceding sections, and in Section 3 of Part II; anyone desiring to examine in full the bases of our conclusions should read Part II, and study the data presented in Parts III and IV.

II. THE METHOD USED

1. RÉSUMÉ OF THE PRECEDING STUDY

In the January number of THE REVIEW OF ECONOMIC STATISTICS fifteen monthly series of business statistics were presented and analyzed. Each item was conceived to be a compound or composite, that is, each actual figure was conceived to be a magnitude determined by the concurrent action of distinct causes. A method was developed of measuring and eliminating those constituents of the items of time series ascribable to secular trend and seasonal variation. The method developed was applied to the fifteen series of business statistics covering periods of from sixteen to twenty-six years.

The need of eliminating secular trend and seasonal variation from statistical series before attempting to employ them as indices of business conditions, as well as the method which we have used in such elimination, may be made clear by a simple illustration. Our purpose is to judge the significance of items for different dates. Let us take the production of pig iron in the United States at any three dates some distance apart from each other. The tonnage of pig iron produced in the United States in March 1904 was 1,447,000, the tonnage in February 1908 was 1,077,000, while the tonnage in December 1918 was 3,434,000. Which one of these figures indicates the greatest relative activity of the iron industry, relative, that is, with respect to the facilities of the industry at the time in question? To answer this question we must take account of the fact that the country and the iron industry have grown in the interval from March 1904 to December 1918. It is obvious that if the growth were by equal monthly increments, a "normal" of 1,528,000 tons in March 1904, for instance, would not be normal in 1908 or 1918. On the assumption of uniform growth the normal of February 1908 would be 1,901,000 tons, and that of December 1918 would be 2,932,000 tons. The actual production figures for the three months are 1,447,000 tons, 1,077,000 tons, and 3,434,000 tons, respectively. The ratios of the actual figures to the corresponding "normal" figures are 95 per cent, 57 per cent, and 117 per cent, respectively. Omitting the percentage signs, the figures just given are termed indices. They are indices of pig-iron production so constructed, by the